

Hotspots, lifelines, and the SAFRR Haywired earthquake sequence

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Though California has experienced many large earthquakes (San Francisco, 1906; Loma Prieta, 1989; Northridge, 1994), the San Francisco Bay Area has not had a damaging earthquake for 25 years. Earthquake risk and surging reliance on smartphones and the Internet to handle everyday tasks raise the question: is an increasingly technology-reliant Bay Area prepared for potential infrastructure impacts caused by a major earthquake? How will a major earthquake on the Hayward Fault affect lifelines (roads, power, water, communication, etc.)? The U.S. Geological Survey Science Application for Risk Reduction (SAFRR) program's Haywired disaster scenario, a hypothetical two-year earthquake sequence triggered by a M7.05 mainshock on the Hayward Fault, addresses these and other questions.

We explore four geographic aspects of lifeline damage from earthquakes: (1) geographic lifeline concentrations, (2) areas where lifelines pass through high shaking or potential ground-failure zones, (3) areas with diminished lifeline service demand due to severe building damage, and (4) areas with increased lifeline service demand due to displaced residents and businesses. Potential mainshock lifeline vulnerability and spatial demand changes will be discerned by superimposing earthquake shaking, liquefaction probability, and landslide probability damage thresholds with lifeline concentrations and with large-capacity shelters. Intersecting high hazard levels and lifeline clusters represent potential lifeline susceptibility hotspots. We will also analyze possible temporal vulnerability and demand changes using an aftershock shaking threshold. The results of this analysis will inform regional lifeline resilience initiatives and response and recovery planning, as well as reveal potential redundancies and weaknesses for Bay Area lifelines. Identified spatial and temporal hotspots can provide stakeholders with a reference for possible systemic vulnerability resulting from an earthquake sequence.